

WHAT IS CLAIMED IS:

1. An electrode pad for a Group III nitride compound semiconductor having p type conduction, comprising:

a first metal layer formed on at least one of said semiconductor and an electrode layer formed on said semiconductor, a second metal layer formed on said first metal layer, and a third metal layer formed on said second metal layer;

a protection film covering over said third metal layer and exposing central portion of said third metal layer; and

wherein said second metal layer is made of gold (Au), said first metal layer comprises a material that has an ionization potential lower than gold (Au), and said third metal layer comprises a material that has an adhesiveness to said protection film which is stronger than gold (Au).

2. An electrode pad according to claim 1, wherein said material of said first metal layer includes at least one of nickel (Ni), iron (Fe), copper (Cu), chromium (Cr), tantalum (Ta), vanadium (V), manganese (Mn), aluminum (Al), and silver (Ag).

3. An electrode pad according to claim 1, wherein said material of said third metal layer includes at least one of aluminum (Al), nickel (Ni), and titanium (Ti).

4. An electrode pad according to claim 1, wherein said protection film is made of silicon oxide ( $SiO_2$ ).

5. An electrode pad according to claim 1, wherein

said material of said first metal layer is nickel (Ni) and said material of said third metal layer is aluminum (Al).

6. An electrode pad according to claim 1, wherein said electrode layer has a multi-layer structure at least having a first electrode layer formed on said semiconductor and a second electrode layer formed on said first electrode layer, wherein said first electrode layer comprises material having an ionization potential that is lower than that of said second electrode layer, said material of said second electrode layer has an ohmic characteristic to said semiconductor better than that of said first electrode layer, and said material of said second electrode layer being distributed more deeply into said semiconductor than that of said first electrode layer by heat treatment.

7. An electrode pad according to claim 6, wherein said material of said first electrode layer includes at least one of nickel (Ni), iron (Fe), copper (Cu), chromium (Cr), tantalum (Ta), vanadium (V), manganese (Mn), aluminum (Al), and silver (Ag), and said material of said second electrode layer includes at least one of palladium (Pd), gold (Au), iridium (Ir), and platinum (Pt).

8. An electrode pad according to claim 6, wherein said material of said first electrode layer is nickel (Ni) and said material of said second electrode layer is gold (Au).

9. An electrode pad according to claim 6, wherein said heat treatment is carried out in the range of 400 °C

to 700 °C.

10. A Group III nitride compound semiconductor device having the electrode pad of claim 1 and further comprising: semiconductor layers having Group III nitride compound semiconductor and satisfying the formula,  $Al_xGa_yIn_{1-x-y}N$ , wherein  $0 \leq x \leq 1$ ,  $0 \leq y \leq 1$ , and  $0 \leq x+y \leq 1$ .

11. A semiconductor device of claim 10, wherein said device is one of a light-emitting diode (LED), a light-emitting laser diode (LD) and a transistor.

12. A light-emitting semiconductor device of a Group III nitride compound semiconductor with p-type conduction, comprising:

a surface layer;

a multi-layered electrode layer comprising a first electrode layer formed on said surface layer and a second electrode layer formed on said first electrode layer;

an electrode pad covering a portion of said second electrode layer and leaving another portion of said second electrode layer uncovered; and

wherein said first electrode layer comprises a material which has an ionization potential lower than that of said second electrode layer.

said second electrode layer comprises a material which has an ohmic characteristic to said semiconductor better than that of said first electrode layer, and

the portion of said material of said second electrode layer which is uncovered by said electrode pad is distributed more deeply into said surface layer than that

of said first electrode layer by heat treatment and provides a contact resistance between said electrode layer and said surface layer lower than said portion covered with said electrode pad.

13. A semiconductor device according to claim 12, wherein said material of said first electrode layer includes at least one of nickel (Ni), iron (Fe), copper (Cu), chromium (Cr), tantalum (Ta), vanadium (V), manganese (Mn), aluminum (Al), and silver (Ag) and said material of said second electrode layer includes at least one of palladium (Pd), gold (Au), iridium (Ir), and platinum (Pt).

14. A semiconductor device according to claim 12, wherein said material of said first electrode layer is nickel (Ni) and said material of said second electrode layer is gold (Au)

15. A method for manufacturing a light-emitting semiconductor device of Group III nitride compound semiconductor with p-type conduction, said method comprising:

providing a surface layer;  
forming a multi-layered electrode layer comprising a first electrode layer formed on said surface layer and a second electrode layer formed on said first electrode layer, said first electrode layer comprising a material having ionization potential lower than that of said second electrode layer and said second electrode layer comprising a material having an ohmic characteristic to said semiconductor better than that of said first electrode

layer;

forming an electrode pad covering a portion of said second electrode layer and leaving another portion of said second electrode layer uncovered; and

providing a heat treatment so that the portion of said material of said second electrode layer which is uncovered by said electrode pad is distributed more deeply into said surface layer than that of said first electrode layer and provides a contact resistance between said electrode layer and said surface layer lower than said portion covered with said electrode pad.

16. A method according to claim 15, wherein said material of said first electrode layer includes at least one of nickel (Ni), iron (Fe), copper (Cu), chromium (Cr), tantalum (Ta), vanadium (V), manganese (Mn), aluminum (Al), and silver (Ag) and said material of said second electrode layer includes at least one of palladium (Pd), gold (Au), iridium (Ir), and platinum (Pt).

17. A method according to claim 15, wherein said material of said first electrode layer is nickel (Ni) and said material of said second electrode layer is gold (Au).

18. A method according to claim 15, wherein said heat treatment is carried out in the range from about 400 °C to 700 °C.

19. A method according to claim 15, wherein said Group III nitride compound semiconductor satisfies the formula  $Al_xGa_yIn_{1-x-y}N$ , wherein  $0 \leq x \leq 1$ ,  $0 \leq y \leq 1$ , and  $0 \leq x+y \leq 1$ .